

ARSET

Applied Remote Sensing Training

<http://arset.gsfc.nasa.gov>

 @NASAARSET

How Can Health Professionals Use NASA Data: Acquiring and Using Environmental Data for Health Applications

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Outline

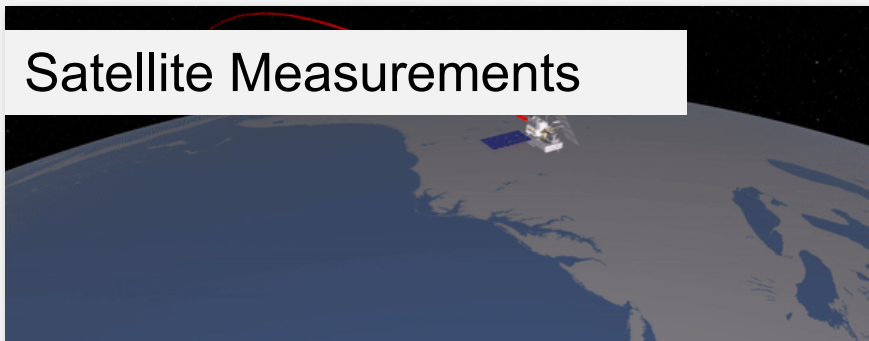
- Working with the Environmental Public Health Community
- Project Examples
- You have a health issue and want to determine if remote sensing data can be beneficial
- Acquiring remote sensing data
- Acquiring health data
- Linking remote sensing and health data
- Homework

| Challenges Working with the Environmental Public Health Community (International & Domestic)

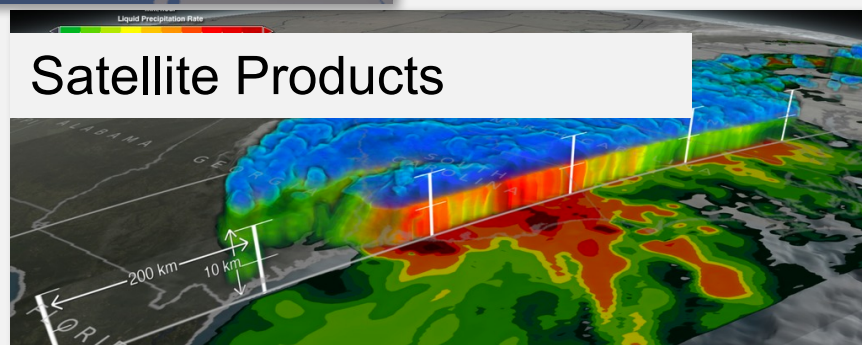
- Sharing data between agencies with different missions and mindsets
- Protecting confidentiality of information
- Ensuring high quality geocoded data
- Ensuring appropriate spatial and temporal resolution of environmental data
- Developing sound resources and methods for conducting data linkages and data analysis

Observations to Applications

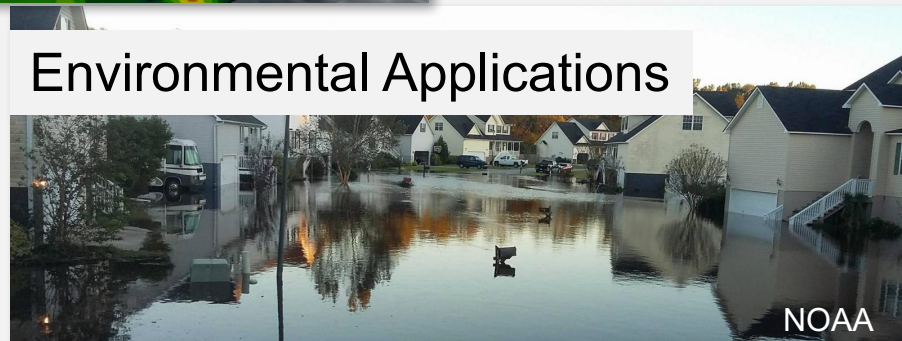
Satellite Measurements



Satellite Products



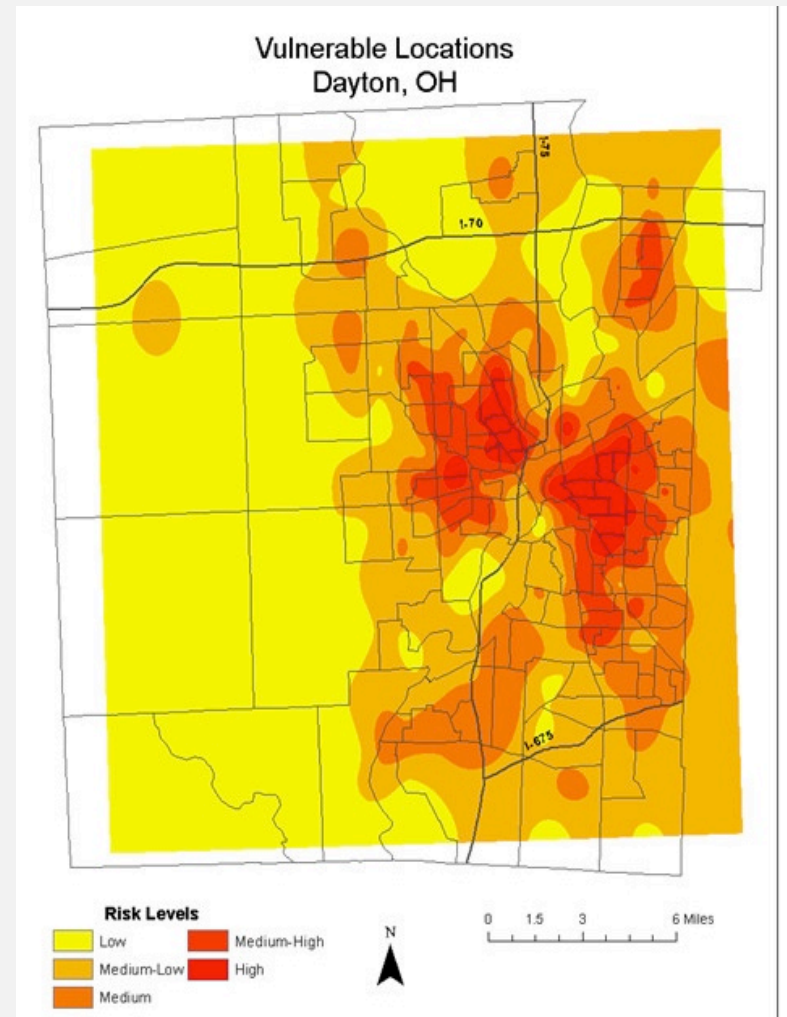
Environmental Applications



Examples of Data Applications

Environmental Public Health

- Remote sensing and modeling data, along with other sources of data, are used for a variety of applications, either:
 - directly
 - in statistical or physical modeling tools
- Remotely sensed data can be used:
 - to identify the hottest areas
 - improve identification of locations most vulnerable during extreme heat events

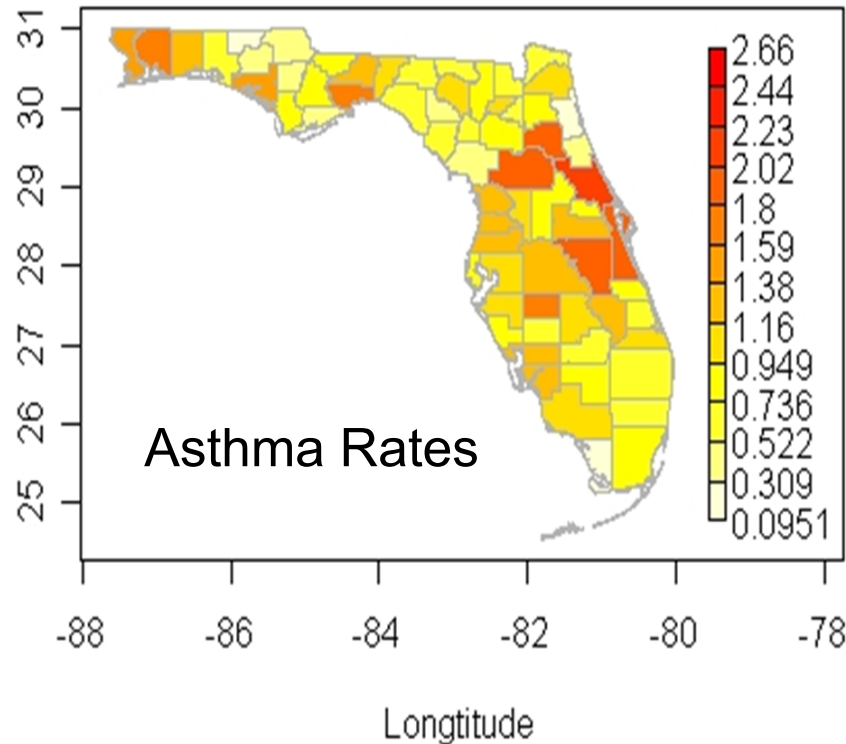
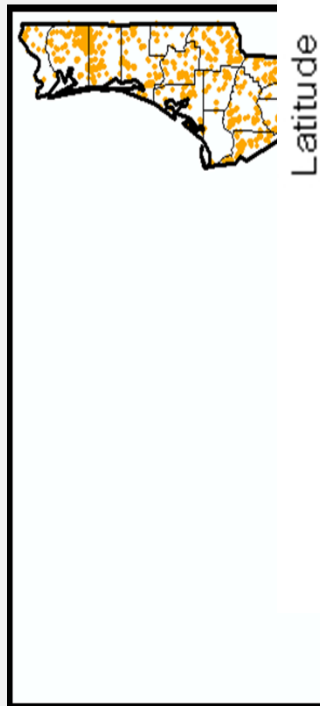


Examples of Data Applications

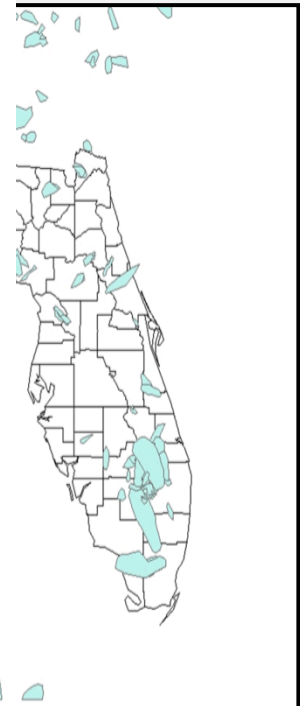
Fires, Smoke, and Public Health

- This environmental data can be combined with public health data to evaluate the effects of fires on populations in Florida or other U.S. regions

2007 MODIS

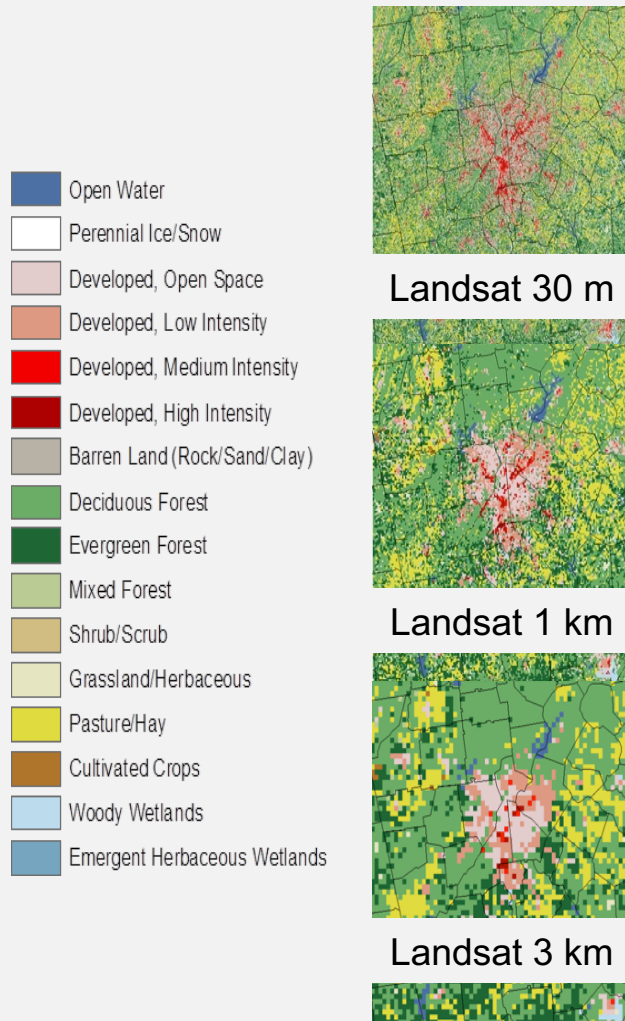


Smoke Plumes

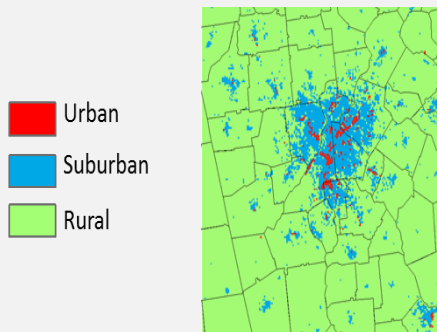


Examples of Data Applications

Relationship Between Living Environment and Blood Pressure



Landsat data was used at the native resolution of 30 m and resampled at other resolution to determine the optimal scale to distinguish urban, suburban, and rural living environments in the metropolitan Atlanta region



Living Environment	Mean SBP	Mean DBP
Urban	131±0.54	78±0.31
Suburban	127±0.42	77±0.24
Rural	127±0.76	76±0.44
<i>p-Value</i>	<i><0.0001</i>	<i>>0.0001</i>

Health Problem

- What question or questions are you trying to answer?
- What type environmental data products do you need that NASA could provide?
 - Land Cover/Land Use: blood pressure
 - Vegetation Extent: urban heating/heat stroke
 - Slope: natural disasters/landslides
 - Air Quality: respiratory illnesses
 - Water Quality (fresh or marine): red tides, respiratory, gastrointestinal illnesses
 - Precipitation: flooding and disasters
 - Soil Moisture: mosquito, vector borne diseases
 - Land Surface Temperature: extreme heat

Acquiring Remotely Sensed Data

- NASA
 - Reverb – ECHO NASA <https://reverb.echo.nasa.gov/reverb>
 - EARTHDATA (EOSDIS)
 - Browse and download processed data
- USGS
 - Global Visualization Viewer (GloVis)
 - Earth Explorer (USGS)

Reverb

<http://reverb.echo.nasa.gov/reverb/>

- Next generation metadata and service discovery tool
- Developed using modern web development technologies and presents you with an interface for discovering Earth Science data
- Updated on a monthly basis taking into account your user feedback and other, currently planned enhancements

The screenshot displays the Reverb | ECHO web interface, titled "The Next Generation Earth Science Discovery Tool". The interface is divided into several sections:

- Search Options:** A sidebar on the left with links for Spatial, Search Terms, Temporal, Platforms & Instruments, Campaigns, Processing Levels, and Science Keywords. It also includes "Save Query" and "Clear Criteria" buttons, and a "Feedback?" link.
- Step 1: Select Search Criteria:** The main search area, divided into:
 - Spatial Search:** Features a "Bounding Box" input field with coordinates (-90.736, 163.477, -11.144, 105.680) and a "Satellite" dropdown menu. A map of the world is shown with a red bounding box over the Atlantic Ocean. Below the map is a "Search by ESRI shape file" link.
 - Search Terms:** Includes a text input field with "e.g. MODIS Fire AST_L1A" and a "Clear" button. A link "Try out this query in Earthdata Search" is also present.
 - Temporal Search:** Includes "START" and "END" date pickers (YYYY-MM-DD HH:MM:SS) and "Clear" buttons. A note states "all times must be specified in GMT" with links for "Date Range" and "Annual Repeating Dates".
- Step 2: Select Datasets:** A list of datasets with checkboxes and "Add" buttons. The datasets include:
 - 15 Minute Stream Flow Data: USGS (FIFE)
 - 1:100,000-scale Digital Line Graphs (DLG) from the U.S. Geological Survey
 - 2000 Pilot Environmental Sustainability Index (ESI)
 - 2001 Environmental Sustainability Index (ESI)
 - 2002 Environmental Sustainability Index (ESI)
 - 2005 Environmental Sustainability Index (ESI)
- Step 3: Discover Granules:** A section at the bottom showing "No Datasets Selected" and buttons for "Search for Granules" and "Search for Granules By ID".

Spatial & Temporal Search

The screenshot displays the EODIS (Earth Observing System Data and Information System) interface, part of NASA's Earth Observing System. The header includes the NASA logo and the text "National Aeronautics and Space Administration". The main title is "EODIS NASA's Earth Observing System Data and Information System". The right side of the header features the "Reverb | ECHO" logo and the tagline "The Next Generation Earth Science Discovery Tool".

The interface is divided into several sections:

- Search Options:** Located on the left, it includes fields for "Spatial Bounding Box" (23.886, -74.531, 40.286, -92.285), "Search Terms", "Temporal Start" (2016-09-16 00:00:00), "Temporal End" (2017-04-16 23:59:59), "Platforms & Instruments", "Campaigns", "Processing Levels", and "Science Keywords". There are also buttons for "Save Query" and "Clear Criteria", and a "Feedback?" link.
- Step 1: Select Search Criteria:** This section is divided into "Spatial Search" and "Search Terms".
 - Spatial Search:** Includes a "Bounding Box" field with the same coordinates as the search options, a "Reset" button, and a "Clear" button. Below this is a map showing the bounding box over the Atlantic Ocean. A "Satellite" dropdown menu is also present. A "Google" logo and a "Drag the corners to adjust their location" instruction are at the bottom of the map. A "Search by ESRI shape file" link is also visible.
 - Search Terms:** Includes a text input field with the example "e.g. MODIS Fire AST_LIA" and a "Clear" button. Below this is a button that says "Try out this query in Earthdata Search".
- Temporal Search:** Located below the search terms, it includes "START" and "END" date pickers. The "START" date is set to "2016-09-16 00:00:00" and the "END" date is set to "2017-04-16 23:59:59". There are "Clear" buttons for both. A note states "* all times must be specified in GMT". Below the date pickers are buttons for "Date Range" and "Annual Repeating Dates".
- Step 2: Select Datasets:** This section displays a list of datasets found. The header indicates "Found 2316 datasets. Total Query Time: 2.56s". The list includes:
 - 1:100,000-scale Digital Line Graphs (DLG) from the U.S. Geological Survey (Archive Center: DOI/USGS-EROS, Short Name: DLG100K, Version: Not provided)
 - 2000 Pilot Environmental Sustainability Index (ESI) (Archive Center: SEDAC, Short Name: CIESIN_SEDAC_ESI_2000, Version: 2000.00)
 - 2001 Environmental Sustainability Index (ESI) (Archive Center: SEDAC, Short Name: CIESIN_SEDAC_ESI_2001, Version: 2001.00)
 - 2002 Environmental Sustainability Index (ESI) (Archive Center: SEDAC, Short Name: CIESIN_SEDAC_ESI_2002, Version: 2002.00)
 - 2005 Environmental Sustainability Index (ESI) (Archive Center: SEDAC, Short Name: CIESIN_SEDAC_ESI_2005, Version: 2005.00)
 - 2008 Environmental Performance Index (EPI)
- Step 3: Discover Granules:** This section is currently empty, showing "No Datasets Selected".

Science Key Words

The screenshot shows the ECHO Reverb interface with the 'Search by Science Keywords' dialog box open. The dialog box contains a list of science keywords and a search criteria table.

Search by Science Keywords

Selecting a parent means all children are included in the search.

Science Keywords

Search for datasets containing ANY of the selected science keywords.

List of Selected Keywords

- HUMAN DIMENSIONS>>HUMAN HEALTH
- HUMAN DIMENSIONS>>HUMAN HEALTH>>ANATOMICAL PARAMETERS
- HUMAN DIMENSIONS>>HUMAN HEALTH>>DISEASES/EPIDEMICS
- HUMAN DIMENSIONS>>HUMAN HEALTH>>PUBLIC HEALTH
- ☐ HABITAT CONVERSIONS/FRAGMENTATION
- ☐ HABITAT CONVERSION/FRAGMENTATION
- ☐ HABITAT CONVERSION/FRAGMENTATION
- ☒ HUMAN HEALTH
 - ☒ ANATOMICAL PARAMETERS
 - ☒ DISEASES/EPIDEMICS
 - ☒ PUBLIC HEALTH
 - ☒ VITAL STATISTICS
- ☐ HUMAN SETTLEMENTS
- ☐ INFRASTRUCTURE
- ☐ LAND USE/LAND COVER
- ☐ NATURAL HAZARDS
- ☐ POPULATION

Search Criteria

Search Term	Start	End	Units
AST L1A			
Temporal Search			
16-09-16 00:00:00			
17-04-16 23:59:59			

Feedback? Tell us what you think.

The screenshot shows the ECHO Reverb interface with the 'Search by Science Keywords' dialog box open. The dialog box contains a list of science keywords and a search criteria table.

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- HUMAN DIMENSIONS>>HUMAN HEALTH>>DISEASES/EPIDEMICS
- HUMAN DIMENSIONS>>HUMAN HEALTH>>PUBLIC HEALTH
- ☐ LAND USE/LAND COVER
- ☐ NATURAL HAZARDS
- ☐ POPULATION
- ☒ PUBLIC HEALTH
 - ☒ DISEASES/EPIDEMICS
 - ☒ ENVIRONMENTAL HEALTH FACTORS
 - ☒ MALNUTRITION
 - ☒ MORBIDITY
 - ☒ RADIATION EXPOSURE
- ☐ SOCIAL BEHAVIOR
- ☐ SOCIOECONOMICS
- ☐ SOCIOECONOMICS
- ☐ EXISTING INFRASTRUCTURE

Search Criteria

Search Term	Start	End	Units
AST L1A			
Temporal Search			
16-09-16 00:00:00			
17-04-16 23:59:59			

Feedback? Tell us what you think.

Science Key Words

NASA National Aeronautics and Space Administration

EODIS NASA's Earth Observing System Data and Information System

Reverb | ECHO The Next Generation Earth Science Discovery Tool

Search Options

Spatial Bounding Box: 23.886, -74.531, 40.286, -92.285

Search Terms

Temporal Start: 2007-09-16 00:00:00 End: 2017-04-16 23:59:59

Platforms & Instruments [?]

Campaigns [?]

Processing Levels [?]

Science Keywords [?]

Search by Science Keywords

Selecting a parent means all children are included in the search.

Science Keywords

Search for datasets containing ANY of the selected science keywords.

List of Selected Keywords

- HUMAN DIMENSIONS->HUMAN HEALTH
- HUMAN DIMENSIONS->HUMAN HEALTH->ANATOMICAL PARAMETERS
- HUMAN DIMENSIONS->HUMAN HEALTH->DISEASES/EPIDEMICS
- HUMAN DIMENSIONS->HUMAN HEALTH->PUBLIC HEALTH
- ☒ LAND SURFACE TEMPERATURE
- ☐ SKIN TEMPERATURE
- ☐ LAND USE/LAND COVER
- ☐ LAND USE/LAND COVER
- ☐ LANDSCAPE
- ☐ SOILS
- ☐ SURFACE RADIATIVE PROPERTIES

Feedback? Tell us what you think.

Found 20 datasets. Total Query Time: 2.55s

Step 3: Discover Granules

No Datasets Selected

EODIS NASA's Earth Observing System Data and Information System

Reverb | ECHO The Next Generation Earth Science Discovery Tool

Search Options

Spatial Bounding Box: 23.886, -74.531, 40.286, -92.285

Search Terms

Temporal Start: 2007-09-16 00:00:00 End: 2017-04-16 23:59:59

Platforms & Instruments [?]

Campaigns [?]

Processing Levels [?]

Science Keywords [?]

Search by Science Keywords

Selecting a parent means all children are included in the search.

Science Keywords

Search for datasets containing ANY of the selected science keywords.

List of Selected Keywords

- HUMAN DIMENSIONS->HUMAN HEALTH
- HUMAN DIMENSIONS->HUMAN HEALTH->ANATOMICAL PARAMETERS
- HUMAN DIMENSIONS->HUMAN HEALTH->DISEASES/EPIDEMICS
- HUMAN DIMENSIONS->HUMAN HEALTH->PUBLIC HEALTH
- ☒ LAND SURFACE TEMPERATURE
- ☐ SKIN TEMPERATURE
- ☐ LAND USE/LAND COVER
- ☐ LAND USE/LAND COVER
- ☐ LANDSCAPE
- ☐ SOILS
- ☐ SURFACE RADIATIVE PROPERTIES

Feedback? Tell us what you think.

Found 20 datasets. Total Query Time: 2.55s

Step 3: Discover Granules

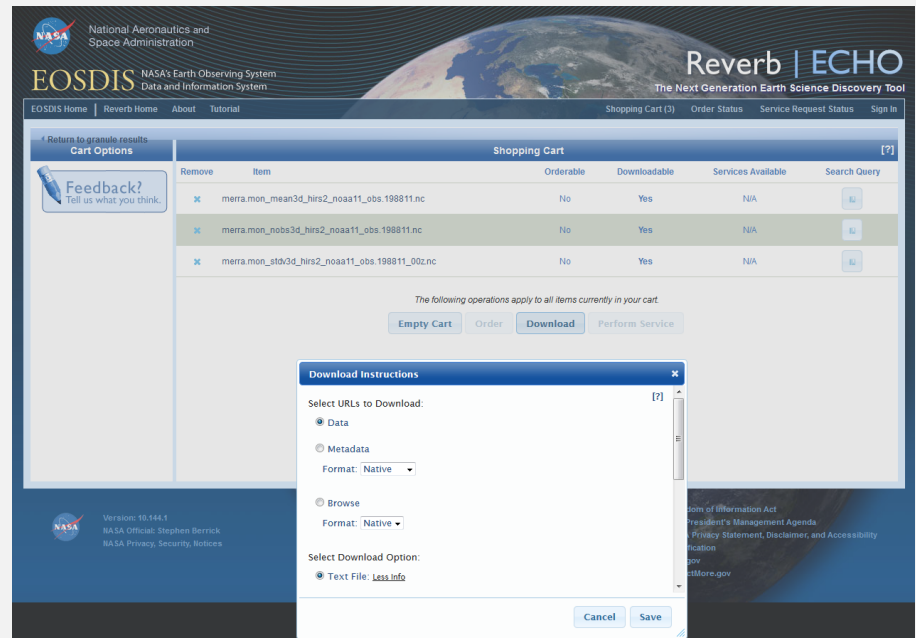
No Datasets Selected

Granule Results

Granule ID	Start Time	End Time	Online Access	Browse
MOD11A2.A2000057.h24v15.004.2002357072	2000-02-26 00:00:05 UTC	2000-03-04 23:59:53 UTC	✓	Browse
MOD11A2.A2000057.h17v13.004.2002357091	2000-02-26 00:00:05 UTC	2000-03-04 23:59:52 UTC	✓	Browse
MOD11A2.A2000057.h16v09.004.2002357092	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	Browse
MOD11A2.A2000057.h17v04.004.2002357120	2000-02-26 00:00:06 UTC	2000-03-04 23:59:52 UTC	✓	Browse
MOD11A2.A2000057.h23v02.004.2002357173	2000-02-26 00:00:06 UTC	2000-03-04 23:48:10 UTC	✓	Browse
MOD11A2.A2000057.h18v00.004.2002357052	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	Browse
MOD11A2.A2000057.h17v00.004.2002357052	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	Browse
MOD11A2.A2000057.h24v02.004.2002357174	2000-02-26 00:00:06 UTC	2000-03-04 23:48:18 UTC	✓	Browse
MOD11A2.A2000057.h31v06.004.2002357093	2000-02-26 00:00:06 UTC	2000-03-04 23:59:53 UTC	✓	Browse

Ordering Granules

- Click on shopping cart icon to retrieve files of interest
 - Order, download or request services
- Using as a guest requires completion of a form each time. If you have an account this will not be needed
- Submit order to begin processing
- Will get order tracking number by email
- ftp links will follow for data download



- HDF format is ingestible into ArcMap/QGIS without data conversion to a geotiff

REVERB Data Retrieval and Ordering Overview

- Search for data using temporal and spatial constraints, specific data attributes, and processing levels
- Use map to drag a bounding box over the region of interest
- Platform and instrument search options menu
- Use calendar widget to set temporal range
- Can add keyword using text field
- When finished, click “search for granules” radio button
- Select granules for shopping cart and order

The screenshot displays the REVERB web interface, which is part of the NASA Earth Observing System Data and Information System (EOSDIS). The interface is titled "Reverb | ECHO The Next Generation Earth Science Discovery Tool". It features a navigation bar with links to "EOSDIS Home", "Reverb Home", "About", and "Tutorial". The main content area is divided into three steps: "Step 1: Select Search Criteria", "Step 2: Select Datasets", and "Step 3: Discover Granules".

Step 1: Select Search Criteria

This step includes a "Spatial Search" section with a "Bounding Box" input field (e.g., -50.736, 163.477, -11.144, 105.680 (S,E,N,W)) and a "Reset" button. Below this is a map of the world with a bounding box highlighted over the Atlantic Ocean. The map is labeled "Satellite" and "Google". A "Feedback?" button is also present. To the right of the map is a "Search Terms" section with a text input field (e.g., "MODIS Fire AST_LIA") and a "Clear" button. Below this is a "Temporal Search" section with "START" and "END" date pickers (YYYY-MM-DD HH MM SS) and a "Clear" button. A note indicates that all times must be specified in GMT, with options for "Date Range" and "Annual Repeating Dates".

Step 2: Select Datasets

This step displays a list of datasets found based on the search criteria. The list includes:

- 15 Minute Stream Flow Data: USGS (FIF) - Archive Center: ORNL_DAC - Short Name: doi:10.3334/ORNLDAAC/1 - Version: 1
- 1:100,000-scale Digital Line Graphs (DLG) from the U.S. Geological Survey - Archive Center: DOI/USGS/EROS - Short Name: DLG100K - Version: Not provided
- 2000 Pilot Environmental Sustainability Index (ESI) - Archive Center: SEDAC - Short Name: CIESIN_SEDAC_ESI_2000 - Version: 2000.00
- 2001 Environmental Sustainability Index (ESI) - Archive Center: SEDAC - Short Name: CIESIN_SEDAC_ESI_2001 - Version: 2001.00
- 2002 Environmental Sustainability Index (ESI) - Archive Center: SEDAC - Short Name: CIESIN_SEDAC_ESI_2002 - Version: 2002.00
- 2005 Environmental Sustainability Index (ESI)

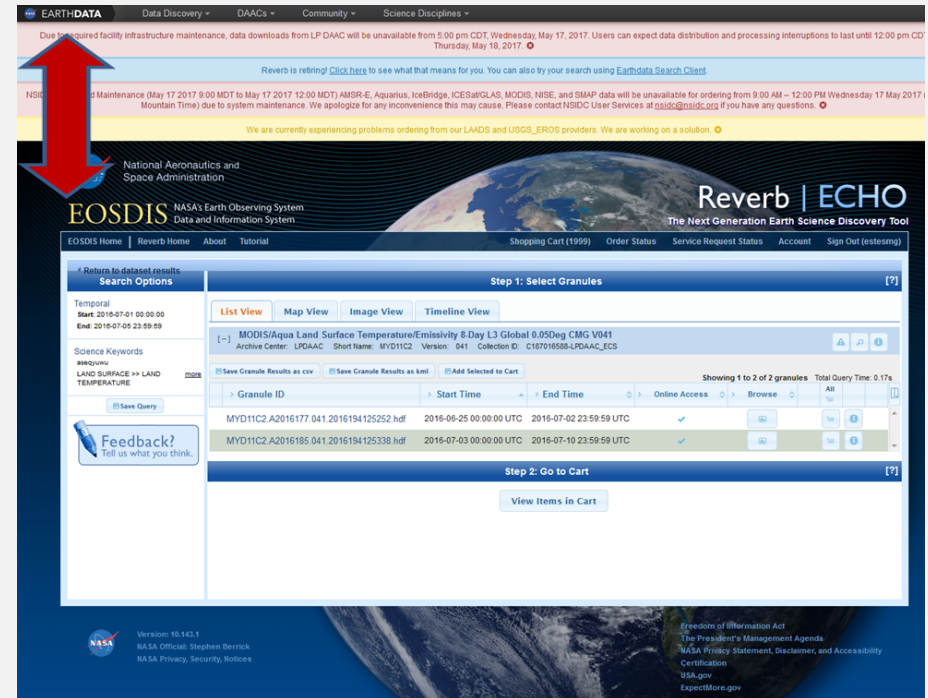
Step 3: Discover Granules

This step shows "No Datasets Selected" and includes buttons for "Search for Granules" and "Search for Granules By ID".

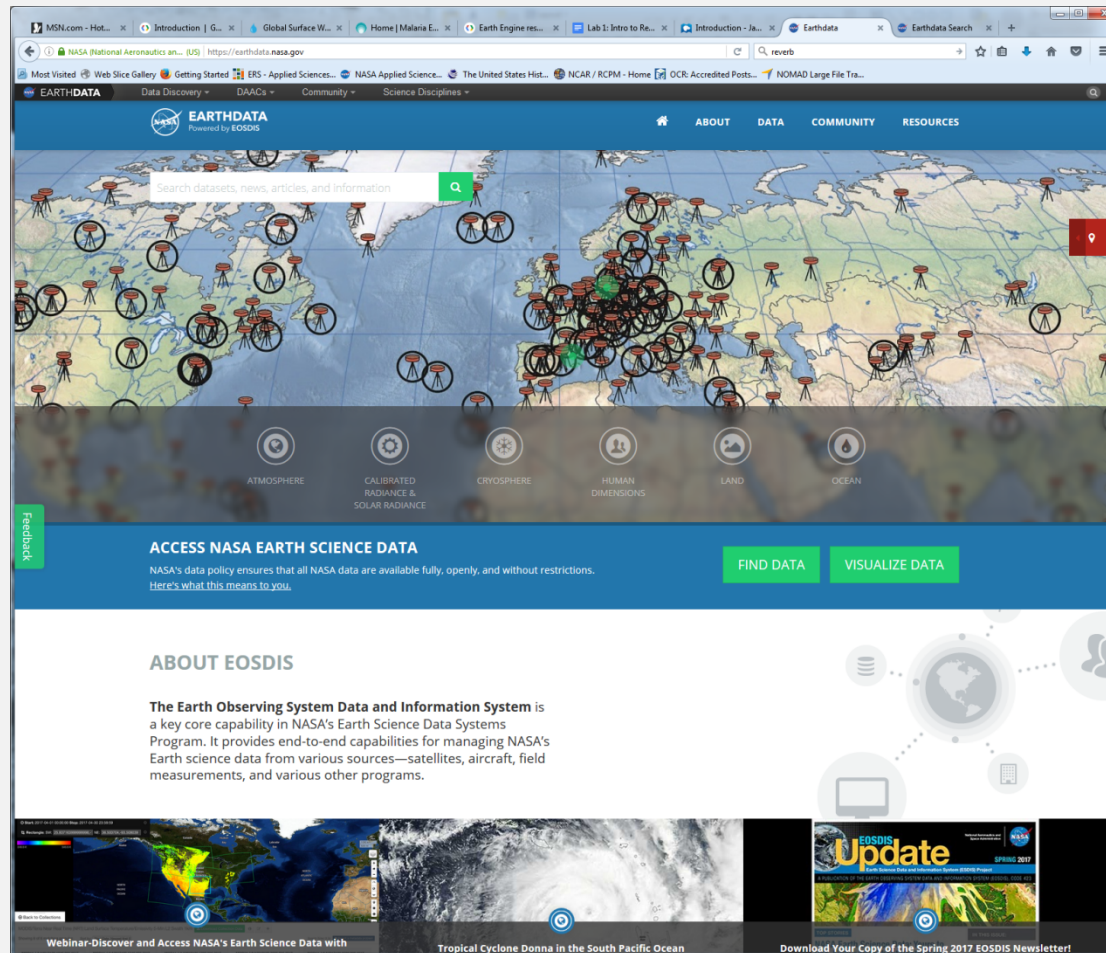
Earthdata

<http://earthdata.nasa.gov/>

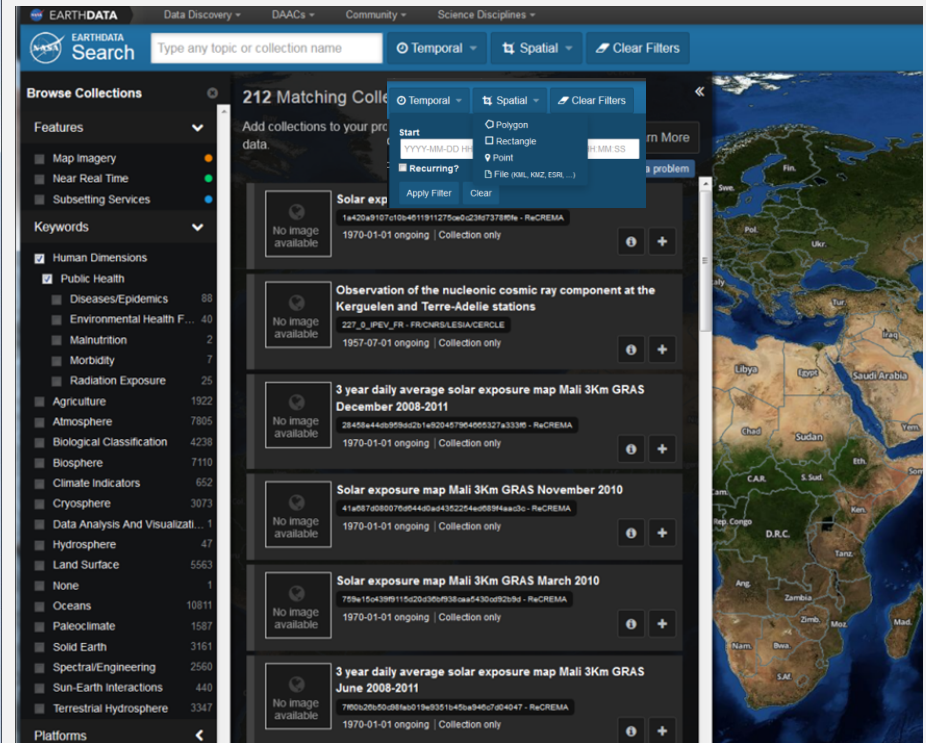
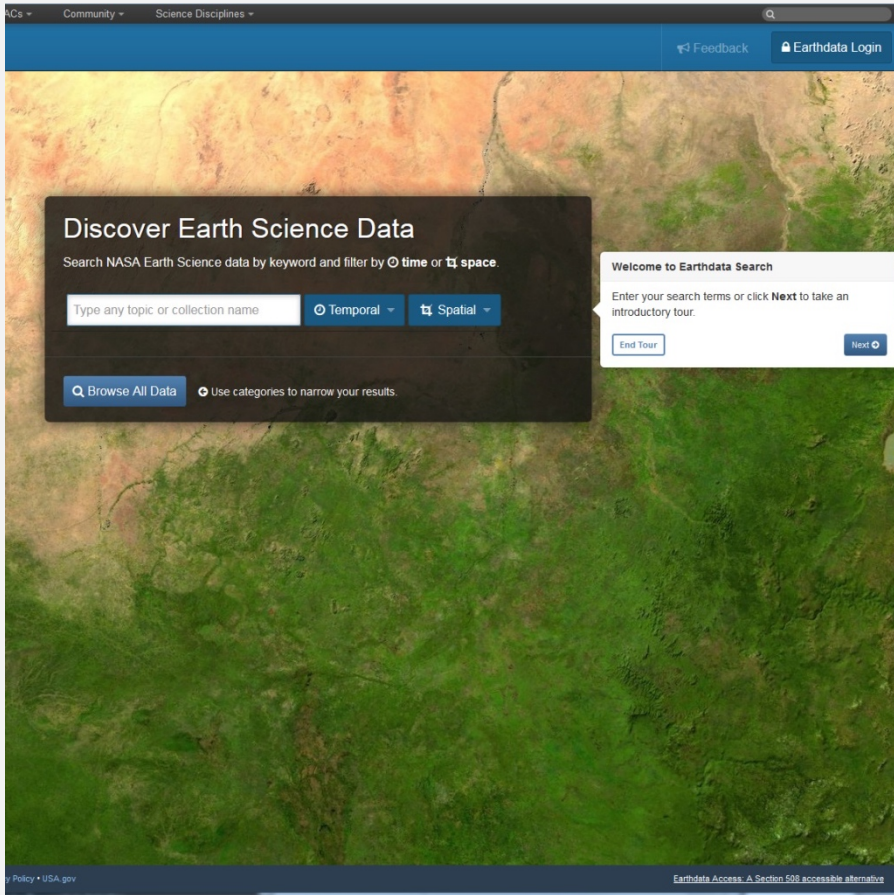
- The Earth Observing System Data and Information System (EOSDIS) is a key core capability in NASA's Earth Science Data Systems Program
- It provides end-to-end capabilities for managing NASA's Earth science data from various sources
 - satellites
 - aircraft
 - field measurements
 - various other programs



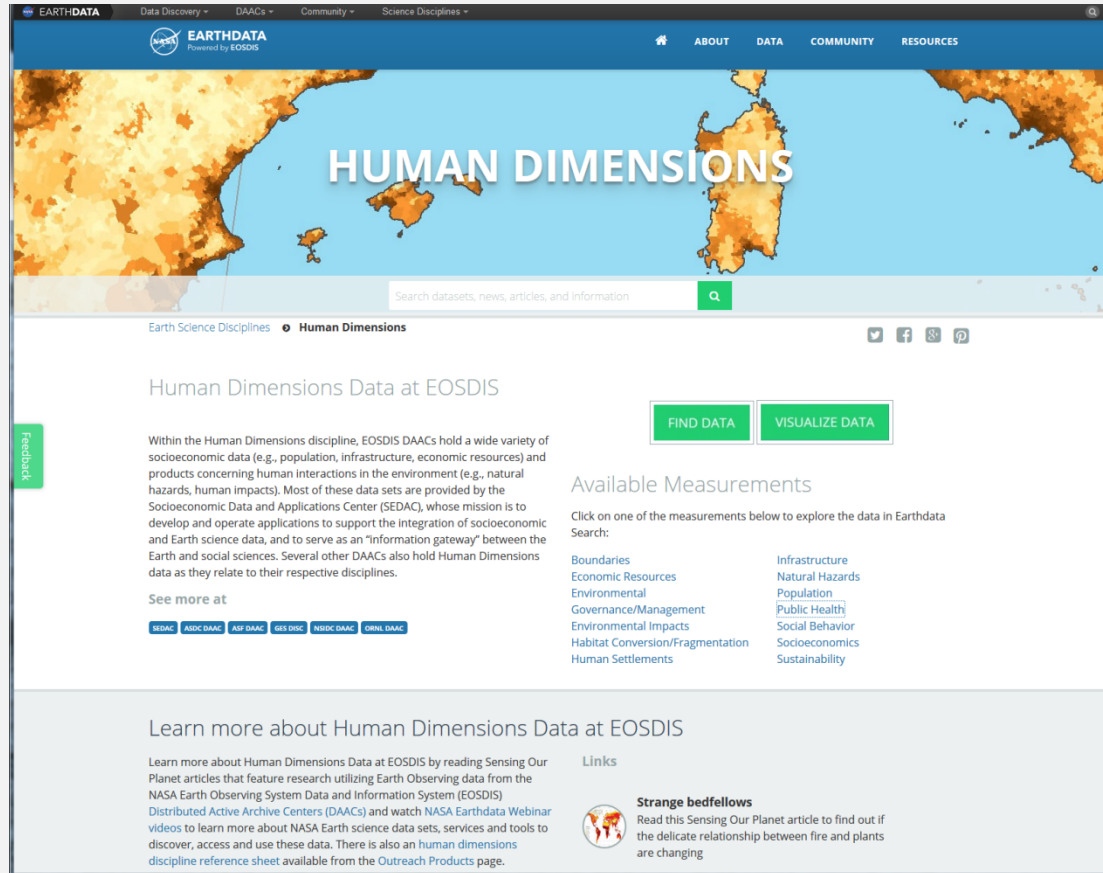
Earthdata



Earthdata: Public Health



Earthdata: Human Dimensions



The screenshot shows the Earthdata website's 'Human Dimensions' section. The header includes the Earthdata logo and navigation links: Data Discovery, DAACs, Community, Science Disciplines, ABOUT, DATA, COMMUNITY, and RESOURCES. A large banner image of the Pacific Ocean with the text 'HUMAN DIMENSIONS' is at the top. Below the banner is a search bar and social media icons. The main content area is titled 'Human Dimensions Data at EOSDIS' and includes a paragraph about the discipline, a 'See more at' section with links to various DAACs, and an 'Available Measurements' section with a list of topics. At the bottom, there is a 'Learn more about Human Dimensions Data at EOSDIS' section with a paragraph and a 'Links' section featuring a 'Strange bedfellows' article.

EARTHDATA Data Discovery DAACs Community Science Disciplines

EARTHDATA
Powered by EOSDIS

ABOUT DATA COMMUNITY RESOURCES

HUMAN DIMENSIONS

Search datasets, news, articles, and information

Earth Science Disciplines • Human Dimensions

Human Dimensions Data at EOSDIS

Within the Human Dimensions discipline, EOSDIS DAACs hold a wide variety of socioeconomic data (e.g., population, infrastructure, economic resources) and products concerning human interactions in the environment (e.g., natural hazards, human impacts). Most of these data sets are provided by the Socioeconomic Data and Applications Center (SEDAC), whose mission is to develop and operate applications to support the integration of socioeconomic and Earth science data, and to serve as an "information gateway" between the Earth and social sciences. Several other DAACs also hold Human Dimensions data as they relate to their respective disciplines.

See more at

SEDAC ASDC DAAC ASIP DAAC SES DDC EOSDC DAAC ORNL DAAC

Available Measurements

Click on one of the measurements below to explore the data in Earthdata Search:

Boundaries	Infrastructure
Economic Resources	Natural Hazards
Environmental	Population
Governance/Management	Public Health
Environmental Impacts	Social Behavior
Habitat Conversion/Fragmentation	Socioeconomics
Human Settlements	Sustainability

Learn more about Human Dimensions Data at EOSDIS

Learn more about Human Dimensions Data at EOSDIS by reading Sensing Our Planet articles that feature research utilizing Earth Observing data from the NASA Earth Observing System Data and Information System (EOSDIS) Distributed Active Archive Centers (DAACs) and watch NASA Earthdata Webinar videos to learn more about NASA Earth science data sets, services and tools to discover, access and use these data. There is also an [human dimensions discipline reference sheet](#) available from the Outreach Products page.

Links

Strange bedfellows
Read this Sensing Our Planet article to find out if the delicate relationship between fire and plants are changing

Earthdata: Environmental Sustainability Example

The screenshot shows the Earthdata Search web application. The search bar contains 'human dimensions'. The left sidebar shows a list of collections under 'Human Dimensions', including 'Environmental Sustainability' (95 items), 'Agriculture' (400 items), 'Atmosphere' (283 items), 'Biological Classification' (155 items), 'Biosphere' (726 items), 'Climate Indicators' (28 items), 'Cryosphere' (76 items), 'Data Analysis And Visualization' (1 item), 'Land Surface' (562 items), 'Oceans' (243 items), 'Paleoclimate' (18 items), 'Solid Earth' (219 items), 'Spectral/Engineering' (133 items), 'Sun-Earth Interactions' (12 items), and 'Terrestrial Hydrosphere' (464 items). The main panel displays '95 Matching Collections'. A list of collections is shown, including 'Environmental Treaty Status Data Set, 2012 Release', 'Pilot 2008 Environmental Performance Index (EPI)', '2008 Environmental Performance Index (EPI)', '2010 Environmental Performance Index (EPI)', '2012 Environmental Performance Index and Pilot Trend Environmental Performance Index', '2014 Environmental Performance Index (EPI)', '2000 Pilot Environmental Sustainability Index (ESI)', and '2001 Environmental Sustainability Index (ESI)'. Each collection entry includes a thumbnail (marked 'No image available'), the collection ID, the time range, and the data source (SEDAC). A map of the Indian Ocean region is visible on the right side of the main panel.

The screenshot shows the Earthdata Search web application with a specific project collection selected. The search bar contains 'human dimensions'. The left sidebar shows a list of collections under 'Human Dimensions'. The main panel displays 'Project Collections'. A 'Download Project Data' button is visible. The selected collection is '2014 Environmental Performance Index (EPI)', with the collection ID 'CIESIN_SEDAC_EPI_2014_v2014.00 - SEDAC'. The time range is '2002-01-01 ongoing' and the data source is 'Collection only'. A map of the Indian Ocean region is visible on the right side of the main panel.

URL Direct Download

The screenshot displays the Earthdata Search web application. The top navigation bar includes the NASA logo, search bar, and various filters like Temporal, Spatial, and Clear Filters. The main content area shows the '2014 Environmental Performance Index (EPI)' dataset. On the left, a metadata panel provides details about the dataset, including spatial coordinates, temporal extent, and related URLs. A 'Related URLs' pop-up is overlaid on the map, listing links for visualization and documentation. The map itself shows a global view with a focus on Africa and the Indian Ocean.

2014 Environmental Performance Index (EPI) VERSION 2014.30

Spatial Coordinates:
Bounding Rectangle: (90.0°, -180.0°, -55.0°, 180.0°)

Temporal Extent:
2002-01-01 ongoing

GIBS Imagery Projection Availability:
None

Metadata Formats: [HTML](#) | [Native](#) | [ATOM](#) | [ECHO10](#) | [ISO19115](#) | [DIF](#)

API Endpoints: [OSDD](#)

Related URLs:
[View All Related URLs](#)

The 2014 Environmental Performance Index (EPI) ranks 178 countries on 20 performance indicators in the following 9 policy categories: health impacts, air quality, water and sanitation, water resources, agriculture, forests, fisheries, biodiversity and habitat, and climate and energy. These categories track performance and progress on two broad policy objectives, environmental health and ecosystem vitality. The EPI's proximity-to-target methodology facilitates cross-country comparisons among economic and regional peer groups. The data set includes the 2014 EPI and component scores, backcast EPI scores for 2002-2012, and time-series source data. The 2014 EPI was formally released in Davos, Switzerland, at the

Processing Center:
Archive Center:
SEDAC
Short Name:
CIESIN_SEDAC_EPI_2014

Science Keywords:
[Earth Science](#) [Agriculture](#) [Agricultural Aquatic Sciences](#)
[Earth Science](#) [Atmosphere](#) [Air Quality](#)
[Earth Science](#) [Biosphere](#) [Ecological Dynamics](#)
[Earth Science](#) [Human Dimensions](#) [Environmental Governance/Management](#)

Related URLs

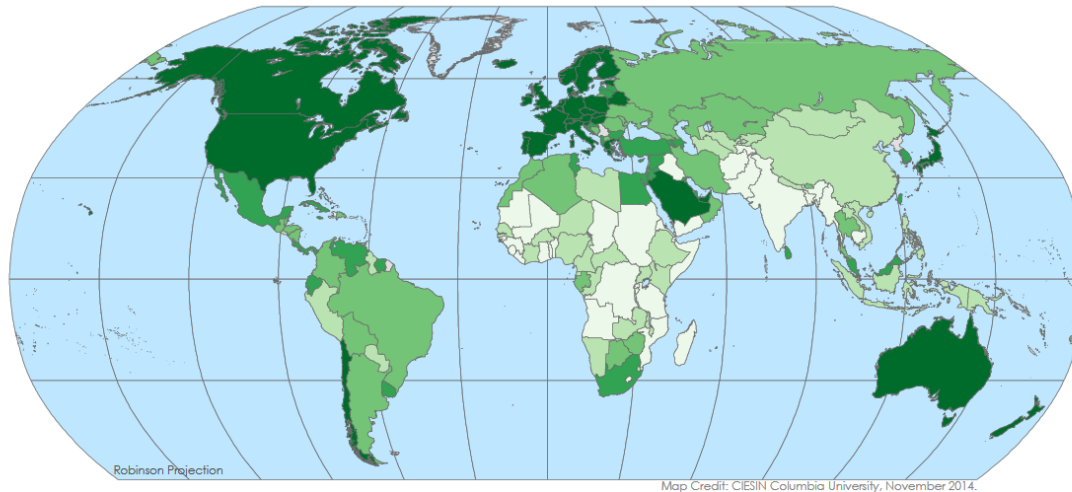
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- [General Documentation](#)
- [General Documentation](#)
- [General Documentation](#)
- [General Documentation](#)

[Close](#)

Sustainability Indicator Example

2014 EPI

Environmental Performance Index (EPI)



The 2014 EPI ranks 178 countries on 20 performance indicators in the following 9 policy categories: health impacts, air quality, water and sanitation, water resources, agriculture, forests, fisheries, biodiversity and habitat, and climate and energy. These categories track performance and progress on two broad policy objectives, environmental health and ecosystem vitality. Each indicator has an associated environmental public health or ecosystem sustainability target. The full report including a complete description of the EPI, underlying data sets, and methodology is available online at the NASA Socioeconomic Data and Applications Center (SEDAC).

2014 EPI Scores

15.47–36.19
36.20–45.50
45.51–53.45
53.46–66.49
66.50–87.67
no EPI score

Center for International Earth
Science Information Network
EARTH INSTITUTE · COLUMBIA UNIVERSITY

Data Source: Yale Center for Environmental Law and Policy - YCELP - Yale University, Center for International Earth Science Information Network - CIESIN - Columbia University, and World Economic Forum - WEF. 2014. 2014 Environmental Performance Index (EPI). Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC).
<http://dx.doi.org/10.7927/H4416V05>.

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Socioeconomic Data and Applications Center (SEDAC)

The screenshot displays the SEDAC website interface. At the top, the NASA logo is followed by the text "SOCIOECONOMIC DATA AND APPLICATIONS CENTER (SEDAC)" and a subtitle "A Data Center in NASA's Earth Observing System Data and Information System (EOSDIS) — Hosted by CIRES at Columbia University". Below this is a navigation bar with links: DATA, MAPS, THEMES, RESOURCES, SOCIAL MEDIA, ABOUT, and HELP. A search bar is also present. The main content area is titled "Environmental Performance Index (EPI)" and "Environmental Performance Index, 2014 Release (2002–2014)". It features a sidebar with links to Data Sets (5), Map Gallery (49), Map Services (24), Citations, FAQs, and Project Website. The main content area includes tabs for Set Overview, Data Download, Maps, Map Services, Documentation, and Metadata. Under the "Data" tab, there is a section for "View Recommended Citation(s)" and a list of downloads: "Full Report and Analysis (19.6 MB pdf file)", "Indicator Metadata (353 KB pdf file)", "EPI 2014 Report:", "2014 EPI (765 KB zipped xls file)", and "EPI 2014 Indicator Time Series Data:". A note states: "The indicator time series data are provided in Excel workbooks by policy category. Note that the availability of time series data varies by indicator." Below this, a list of categories and their file sizes is shown: Health Impacts (133 KB), Air Quality (242 KB), Water and Sanitation (212 KB), Water Resources (48 KB), Agriculture (345 KB), Forests (48 KB), Fisheries (484 KB), Biodiversity and Habitat (328 KB), and Climate and Energy (265 KB). The footer contains the Center for International Earth Science Information Network logo and a list of links: HOME, DATA, DATA USES, DATA CITATIONS, MAPS, MAP SERVICES, NEWS, TOOLS, GUIDES, PUBLICATIONS, BLOG POSTS, ABOUT, HELP, PRIVACY, and USER REGISTRATION. It also includes a copyright notice: "Copyright © 1997–2017. The Trustees of Columbia University in the City of New York." and the ICRI World Data System logo.

Example of EPI data for one air pollutant category

Air Pollution (PM2.5) - Population weighted exposure to PM2.5 (micro-grams per cubic meter)

Source: Aaron van Donkelaar (in prep), 2014 (embargoed)

Notes: NA = Not Applicable

Country	2000	2001	2002	2003
Afghanistan	8.6	8.42	10.64	10.81
Albania	14.73	14.6	13.79	13.77
Algeria	8.28	8.16	8.74	9.12
American Samoa	3.09	3.08	3.13	3.13
Andorra	9.3	3.59	6.66	6.41
Angola	7.85	7.74	7.59	7.86
Anguilla	0.97	0.7	0.97	0.97
Antigua and Barbuda	2.57	2.56	2.7	3.05
Argentina	5.45	5.33	5.34	5.25
Armenia	12.24	9.17	13.36	14
Aruba	4.74	4.74	3.69	3.69
Australia	3.01	2.48	3.32	3.55
Austria	16.41	15.57	15.19	16.93
Azerbaijan	12.93	12.62	11.57	10.49
Bahamas	7.2	7.12	6.31	5.93
Bahrain	8.97	8.97	10.37	10.37
Bangladesh	17	16.97	19.32	20.78
Barbados	2.89	2.88	2.99	3.2

Earthdata Menu

EARTHDATA Data Discovery ▾ DAACs ▾ Community ▾ Science Disciplines ▾

Calibrated Radiance and Solar Radiance

Atmosphere	Calibrated Radiance and Solar Radiance	Cryosphere	Human Dimensions	Land	Ocean
Aerosols	Infrared Wavelengths	Frozen Ground	Boundaries	Erosion/Sedimentation	Bathymetry/Seafloor Topography
Air Quality	Lidar	Glaciers/Ice Sheets	Economic Resources	Frozen Ground	Coastal Process
Altitude	Microwave	Sea Ice	Environmental Governance/Management	Geomorphology	Marine Geophysics
Atmospheric Chemistry (Mesospheric and Thermospheric/Ionospheric)	Platform Characteristics	Snow/Ice	Environmental Impacts	Land Temperature	Ocean Acoustics
Atmospheric Electricity (Lightning)	Radar		Habitat Conversion/Fragmentation	Land Use/Land Cover	Ocean Chemistry
Atmospheric Phenomena	Radio Wave		Human Settlements	Landscape	Ocean Circulation
Atmospheric Pressure	Sensor Characteristics		Infrastructure	Soils	Ocean Heat Budget
Atmospheric Radiation (Radiative Energy Fluxes)	Ultraviolet Wavelengths		Natural Hazards	Surface Radiative Properties	Ocean Optics
Atmospheric Temperature	Visible Wavelengths		Population	Topography	Ocean Pressure
Atmospheric Water Vapor (Humidity)	X-Ray		Public Health	Earth Gases/Liquids	Ocean Temperature
Atmospheric Winds	Ionosphere/Magnetosphere Dynamics		Social Behavior	Geochemistry	Ocean Waves
Clouds	Solar Activity		Socioeconomics	Geodetics	Ocean Winds
Precipitation	Solar Energetic Particle Flux		Sustainability	Geomagnetism	Salinity/Density
	Solar Energetic Particle Process			Geomorphic Landforms/Processes	Sea Ice
				Gravity/Gravitational Field	Sea Surface Topography
				Rocks/Minerals/Crystals	
				Tectonics	

NASA Global Climate Change

NITRD

NOAA

USGEO

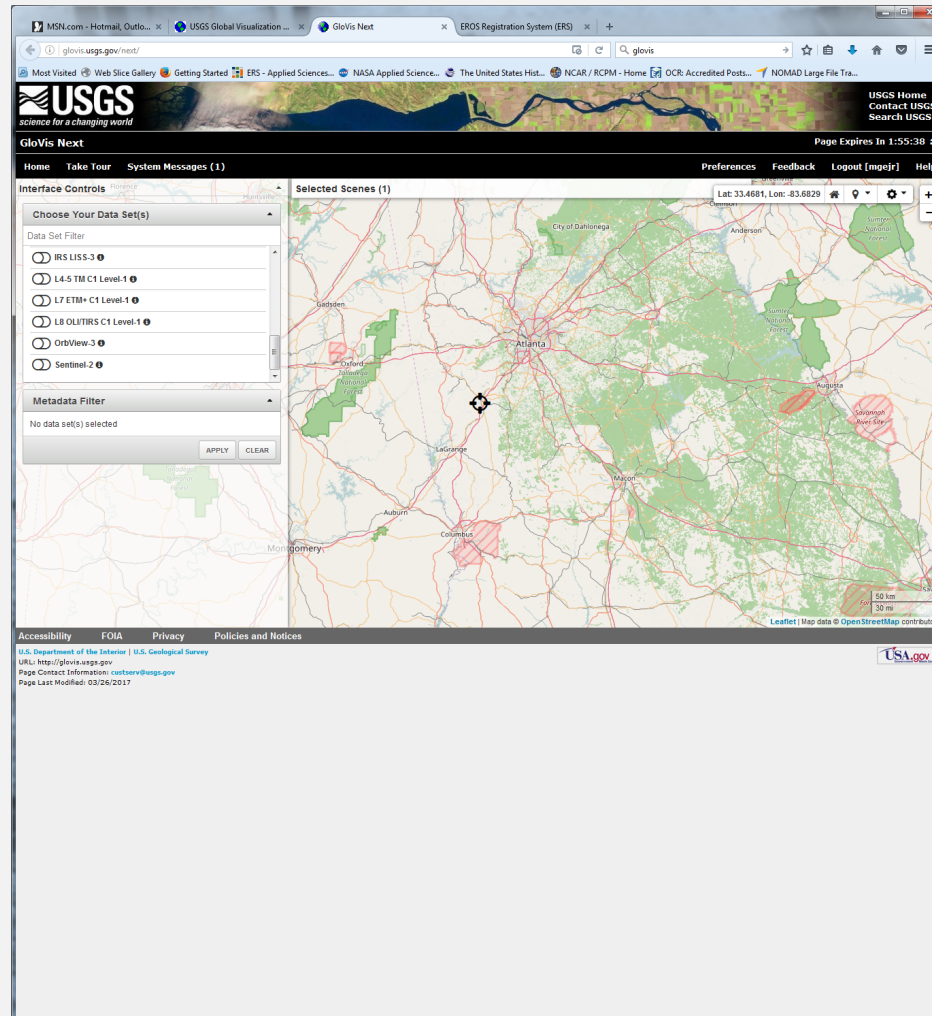
USGS

USGS Data Retrieval Tools

- Global Visualization Viewer (GloVis)
- Earth Explorer

USGS Global Visualization Viewer (GloVis Next)

<http://glovis.usgs.gov/next/>



GloVis Next

The screenshot displays the USGS GloVis Next web application. The header features the USGS logo and navigation links. The main interface is divided into three sections: Interface Controls, Selected Scenes, and a map view.

Interface Controls:

- Choose Your Data Set(s):** Includes filters for L4-5 TM C1 Level-1, L7 ETM+ C1 Level-1, L8 OLI/TIRS C1 Level-1 (selected), OrbView-3, and Sentinel-2.
- Metadata Filter:** Includes filters for Date Range (01/01/2016 to 05/01/2016), Cloud Cover (0-100 or empty to 0-100 or empty), and Months (Jan, Feb).
- Buttons:** APPLY and CLEAR.

Selected Scenes (1): Displays a list of selected scenes.

Map View: Shows a map of the Southeastern United States with a yellow overlay. A black crosshair is centered over Montgomery, Alabama. The map includes a scale bar (200 km, 100 mi) and a legend.

Footer: Includes links for Accessibility, FOIA, Privacy, Policies and Notices, and contact information for the U.S. Department of the Interior and U.S. Geological Survey.

Coverage Area and Scene Selection

The screenshot displays the USGS GLOVIS web application interface, which is used for selecting satellite imagery scenes. The interface is divided into several sections:

- Top Navigation Bar:** Includes the USGS logo, "GLOVIS Next" title, and links for "Home", "Table Tour", "Release Notes", "FAQ", "System Messages (1)", "Preferences", "Feedback", "Logout [mgejr]", and "Help". A "Page Expires In 1:59:35" timer is also present.
- Left Sidebar:**
 - Choose Your Data Set(s):** A list of data sets with checkboxes, including "GLS1975", "GLS1990", "GLS2000", and "GLS2010".
 - Metadata Filter:** A section for filtering data based on "Date Range" (mm/dd/yyyy to mm/dd/yyyy), "Cloud Cover" (0-100 or empty to 0-100 or empty), and "Months" (Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec).
- Main Map Area:** A map showing a large green rectangular area representing the selected scene. The map includes labels for "Atlanta", "LaGrange", "Columbus", and "Macon". A scale bar indicates 50 km and 30 miles.
- Right Panel:** Contains a "Selected Scenes (0)" section with a "Lat: 33.4039, Lon: -82.7490" coordinate display. Below this, a "Scene Information" box shows details for "GLS2010 LT50200372010266GNC01", acquired on "2010-09-23 at 05:00:00", with a "Current Scene Browse Opacity (100%)". Navigation buttons "PREVIOUS", "SELECT", and "NEXT" are at the bottom.
- Footer:** Includes links for "Accessibility", "FOIA", "Privacy", and "Policies and Notices". It also provides contact information for the "U.S. Department of the Interior | U.S. Geological Survey" and the "U.S. Geological Survey" website.

Review Metadata and Download

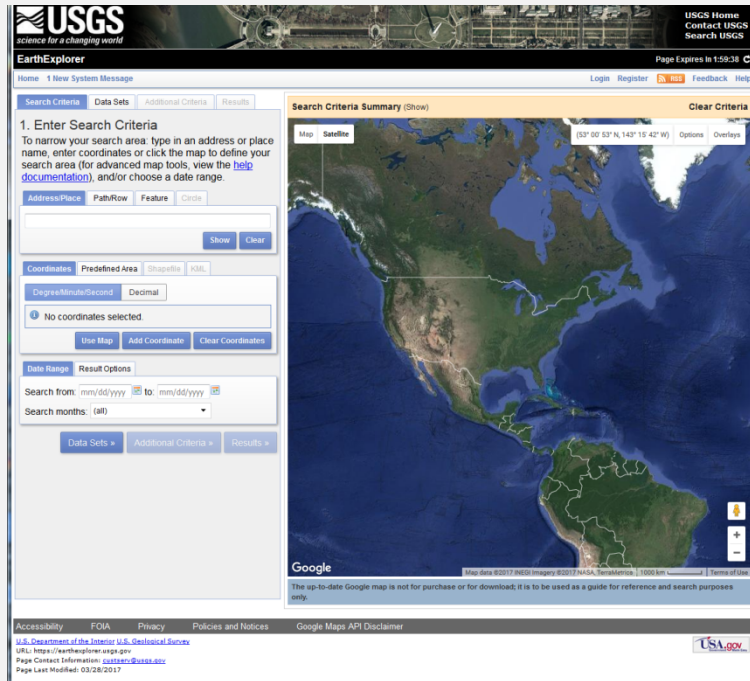
The screenshot displays the USGS GloVis Next web interface. The top navigation bar includes the USGS logo, "science for a changing world", and links for "USGS Home", "Contact USGS", and "Search USGS". The main interface is divided into several sections:

- Interface Controls:** Includes a "Choose Your Data Set(s)" section with radio buttons for "IRS LISS-3", "L4-5 TM C1 Level-1", "L7 ETM+ C1 Level-1", "L8 OLI/TIRS C1 Level-1", "OrbView-3", and "Sentinel-2". Below this is a "Metadata Filter" section with fields for "Date Range" (01/01/2016 to 05/05/2016), "Cloud Cover" (0 to 50), and "Months" (Jan to Feb).
- Selected Scenes (1):** A map view showing a selected scene over a geographical area. The map includes a scale bar and coordinates (Lat: 31.7749, Lon: -89.3848).
- Download Options:** A pop-up window titled "Download Options for LC08_L1TP_024038_20160123_20170..." lists four download options:
 - DOWNLOAD LandsatLook Natural Color Image (8.04 MB)
 - DOWNLOAD LandsatLook Thermal Image (2.32 MB)
 - DOWNLOAD LandsatLook Quality Image (906.02 KB)
 - DOWNLOAD LandsatLook Images with Geographic Reference (11.24 MB)
 - DOWNLOAD Level-1 GeoTIFF Data Product (911.55 MB)
- Metadata Table:** A table displaying the metadata for the selected scene, including fields like Acquisition Date, Collection Category, Collection Number, WRS Path, WRS Row, Target WRS Path, Target WRS Row, Nadir/Off Nadir, Roll Angle, Date L-1 Generated, Start Time, Stop Time, Station Identifier, Day/Night Indicator, Land Cloud Cover, and Snow Cloud Cover.

The bottom of the interface includes a footer with links for "Accessibility", "FOIA", "Privacy", and "Policies and Notices", along with contact information for the U.S. Department of the Interior and U.S. Geological Survey.

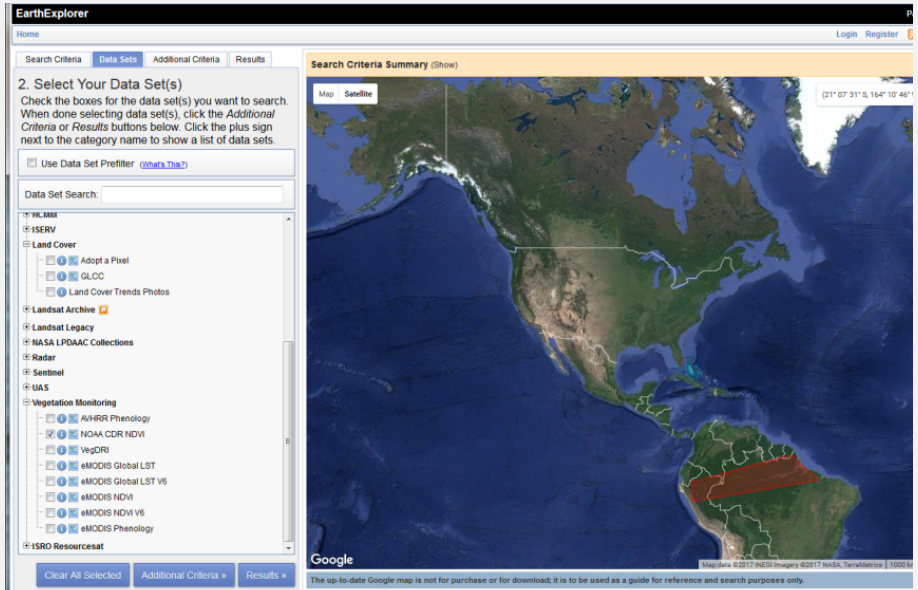
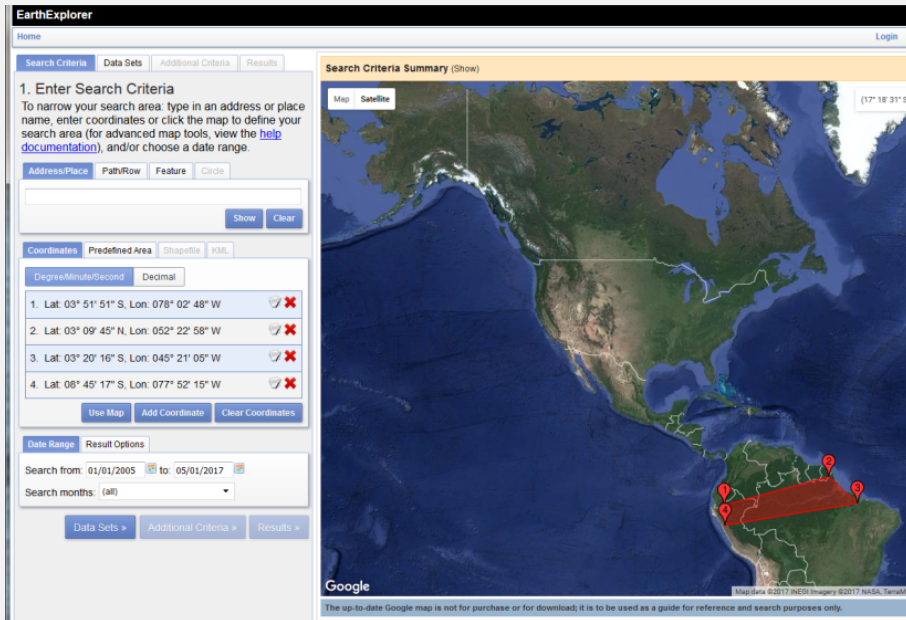
EarthExplorer (EE)

<http://earthexplorer.usgs.gov/>

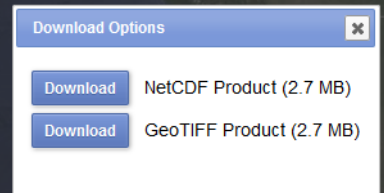
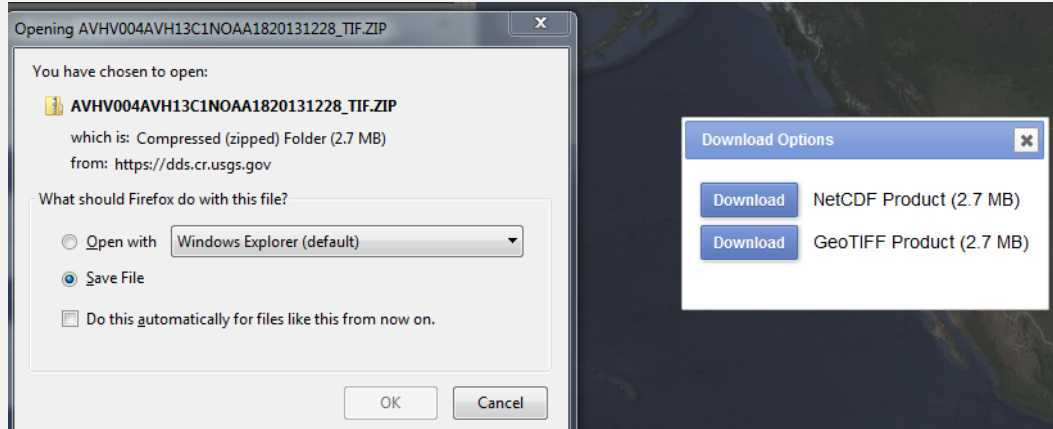
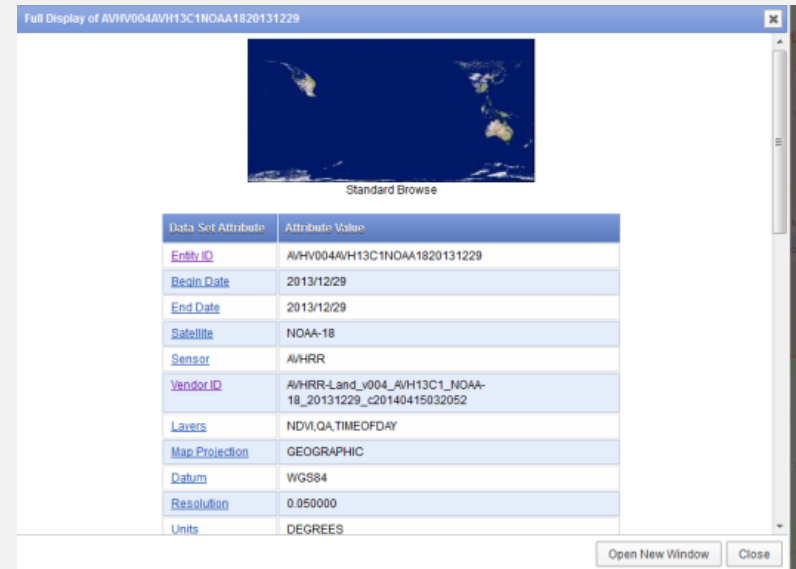
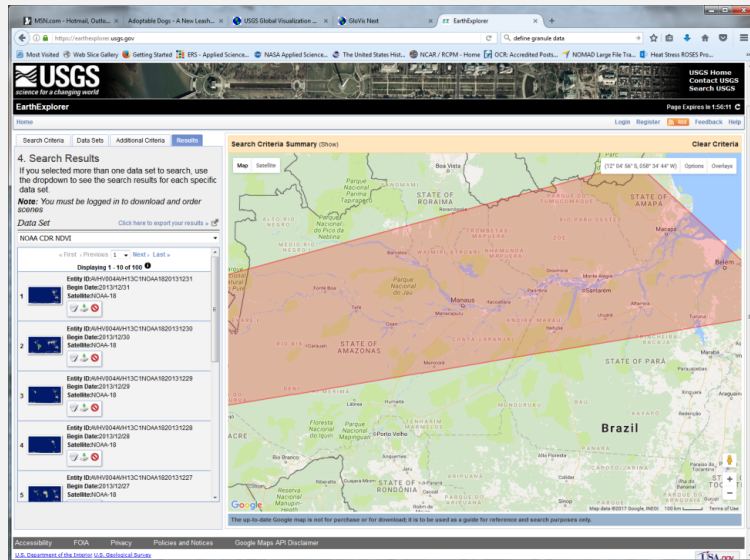


- Spatial search with map
- Select dataset
- Select results
 - Footprint
 - Browse
 - Metadata
 - Download
- Additional Criteria (cloud cover, etc.)
- Must login to download data

Using Earth Explorer



Direct Download of Files



Data Order

USGS
science for a changing world

EarthExplorer

Home 1 New System Message Item Basket (0) estersmg Feedback Help

Order #0101705115060

Note: This order summary page will expire at 5:18 PM CDT. Once expired, it will no longer be available for viewing. An email has been sent to your contact email address containing a copy of this summary.

Entity ID	Product Description	Processing Parameters	Options	Output Media
L1C_T10SGJ_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD
L1C_T10KQD_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD
L1C_T10TGL_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD
L1C_T11TKE_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD
L1C_T10TQK_A009834_20170510T185915	SENTINEL 2A WMS ONDEMAND	None	None	DWNLD

[Return To EarthExplorer](#)

Accessibility FOIA Privacy Policies and Notices Google Maps API Disclaimer

U.S. Department of the Interior U.S. Geological Survey
URL: <https://earthexplorer.usgs.gov>
Page Contact Information: custserv@usgs.gov
Page Last Modified: 03/28/2017

USGS
science for a changing world

EarthExplorer

Home 1 New System Message Save Criteria Load Favorite Manage Criteria Item Basket (0) estersmg Feedback Help

Search Criteria Data Sets Additional Criteria Results

4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Show Result Controls

Data Set Click here to export your results

Sentinel-2

Displaying 1 - 10 of 100

1	Entity ID: L1C_T15TWH_A009833_20170510T172112 Coordinates: 42.8565145, -92.3282569 Acquisition Date: 2017/05/10
2	Entity ID: L1C_T18TYK_A009832_20170510T153559 Coordinates: 40.1176199, -72.0993769 Acquisition Date: 2017/05/10
3	Entity ID: L1C_T18TYL_A009832_20170510T153559 Coordinates: 41.0174452, -71.9690143 Acquisition Date: 2017/05/10
4	Entity ID: L1C_T19TBF_A009832_20170510T153559 Coordinates: 41.020432, -71.9152964 Acquisition Date: 2017/05/10
	Entity ID: L1C_T19TBE_A009832_20170510T153559 Coordinates: 40.1205139, -71.876469

[View Item Basket](#) [Submit Standing Request](#)

Search Criteria Summary (Show) Clear Criteria

Map Satellite (67° 20' 23" N, 116° 53' 40" W) Options Overlays

Google

Map Data ©2017 INEGI Imagery ©2017 NASA, TerraMetrics, 1,000 km Terms of Use

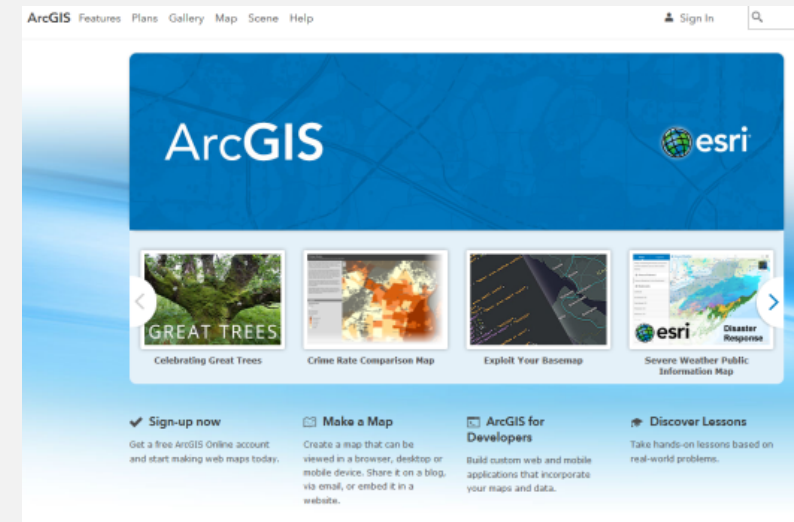
The up-to-date Google map is not for purchase or for download; it is to be used as a guide for reference and search purposes only.

Accessibility FOIA Privacy Policies and Notices Google Maps API Disclaimer

U.S. Department of the Interior U.S. Geological Survey
URL: <https://earthexplorer.usgs.gov>
Page Contact Information: custserv@usgs.gov
Page Last Modified: 03/28/2017

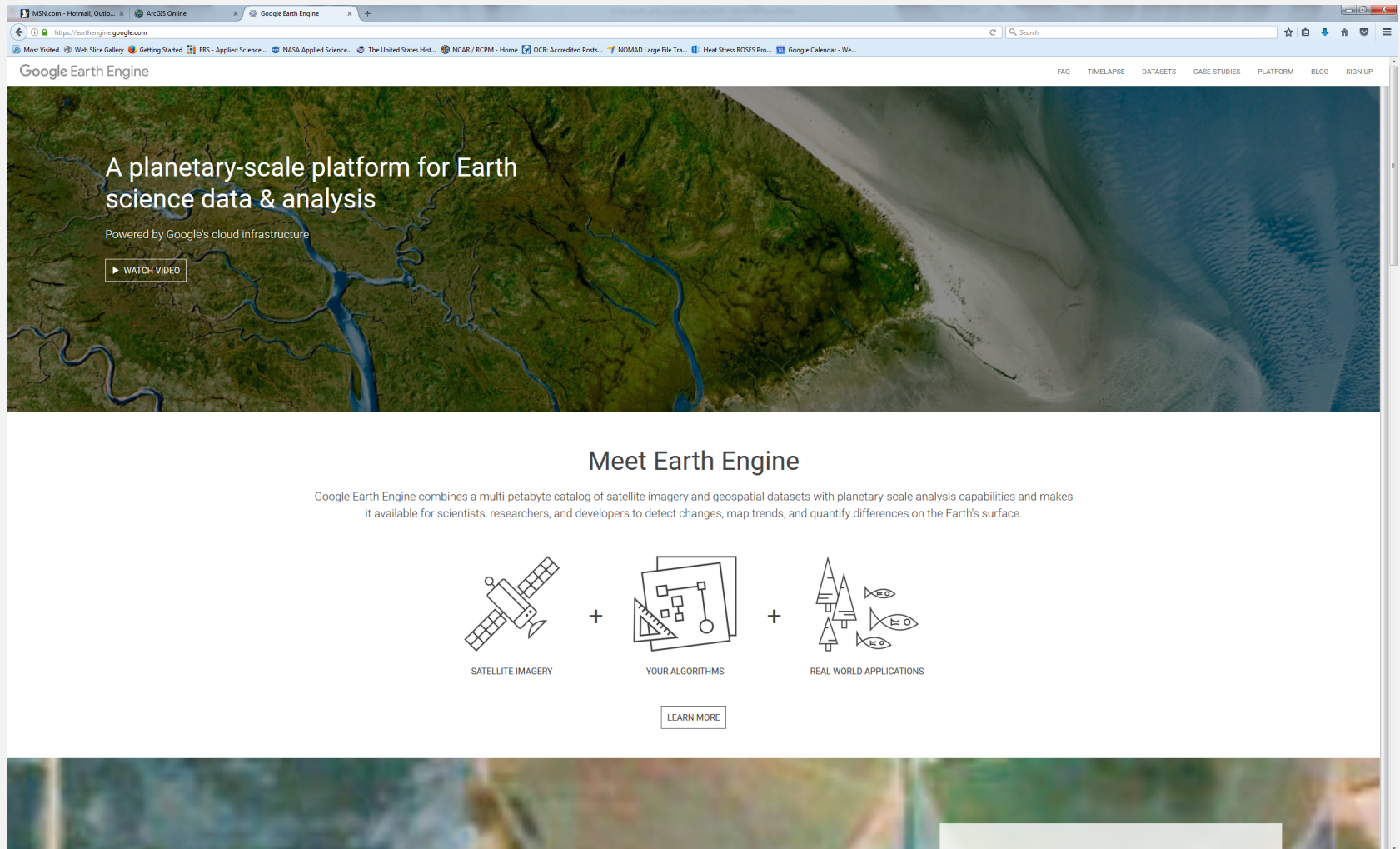
Linking Environmental and Health Data

- Problem: how do I get environmental and health data in the same geographic space for analyses?
 - Open Source Geospatial Tools (R, python, etc.)
 - ArcGIS
 - ArcGIS online (<https://www.arcgis.com/home/index.html>)
 - Erdas/ENVI
 - **Google Earth Engine (GEE)**



GEE

<http://earthengine.google.com/>



Tabs for Timelapse and Datasets

The screenshot displays the Google Earth Engine web interface. At the top, the navigation bar includes links for FAQ, TIMELAPSE, DATASETS, CASE STUDIES, PLATFORM, BLOG, and SIGN UP. The main map area shows a global view with a search bar at the top left and a timeline at the bottom. The timeline is set to 1990, with a play button and a 'Fast' slider. Below the timeline, a row of thumbnail images shows various locations: Miami, Brisbane, Australia, San Jose, Costa Rica, Wuhan, China, San Francisco, Lassen Volcanic Park, Slumby Point, Las Vegas, Alberta, Canada, and Columbia. The 'Timelapse' tab is selected, showing a list of datasets with their respective thumbnails and descriptions.

Timelapse

Landsat

Landsat, a joint program of the USGS and NASA, has been observing the Earth continuously from 1972 through the present day. Today the Landsat satellites image the entire Earth's surface at a 30-meter resolution about once every two weeks, including multispectral and thermal data. Earth Engine makes this data available in its raw form, as TOA-corrected reflectance, and in various ready-to-use computed products such as NDVI and EVI vegetation indices.

[Search Landsat data in Earth Engine.](#)

Sentinel

ESA's Sentinel-1 mission uses radar to image the Earth in all weather conditions, even at night. The satellites capture C-band synthetic aperture radar (SAR) image data at 30- to 120-meter resolution in several polarization modes. Earth Engine includes a growing collection of Sentinel-1 data preprocessed using the Sentinel 1 Toolbox.

[View Sentinel data in Earth Engine.](#)

MODIS

The Moderate Resolution Imaging Spectroradiometer (MODIS) sensors on NASA's Terra and Aqua satellites have been acquiring images of the Earth daily since 1999. The Earth Engine catalog includes a variety of data products that NASA produces from MODIS data, including daily imagery, 16-day BRDF-adjusted surface reflectance, and derived products such as vegetation indices and snow cover.

[Search MODIS data in Earth Engine.](#)

Data Catalogue


Open Sensor of Interest

IMAGERY

GEOPHYSICAL

CLIMATE & WEATHER

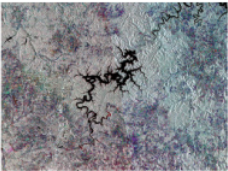
DEMOGRAPHIC



Landsat

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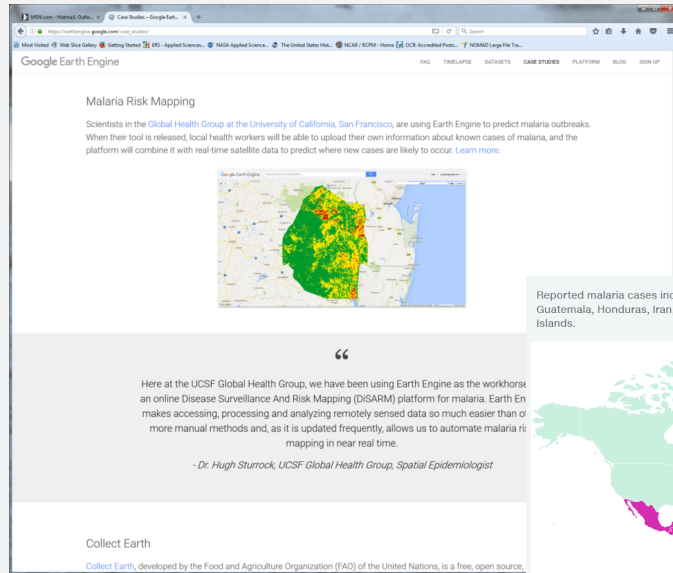


MODIS

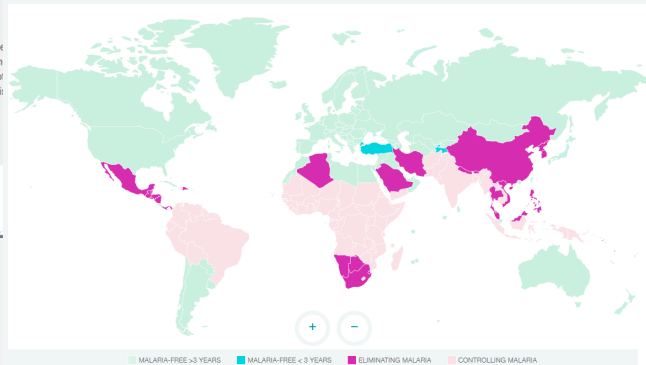
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[Search MODIS data in Earth Engine.](#)

Case Studies

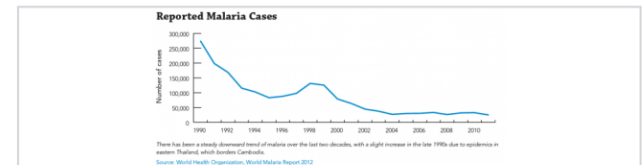


Reported malaria cases increased from 2014 to 2015 in the following 12 countries: Algeria, China, Dominican Republic, Guatemala, Honduras, Iran, Nicaragua, Philippines, Republic of Korea, Sao Tome & Principe, Saudi Arabia, and the Solomon Islands.

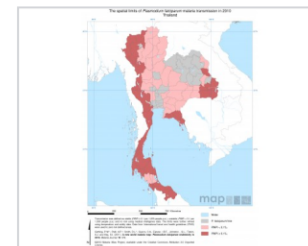


Regional Progress

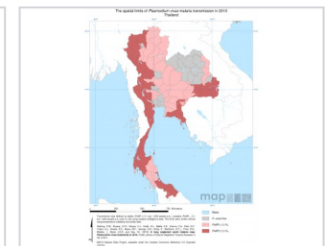
Global malaria eradication will be achieved region by region, requiring greater collaboration among bordering countries. Or the biggest challenges to eliminating malaria is cross-border transmission and importation. Mosquitoes carrying the malar parasite know no borders. Regional initiatives formalize collaboration among countries and create an enabling environment will help achieve elimination targets. Regional collaborations catalyze political commitment, build consensus and engagem



Reported cases



P. falciparum transmission limit (2010)

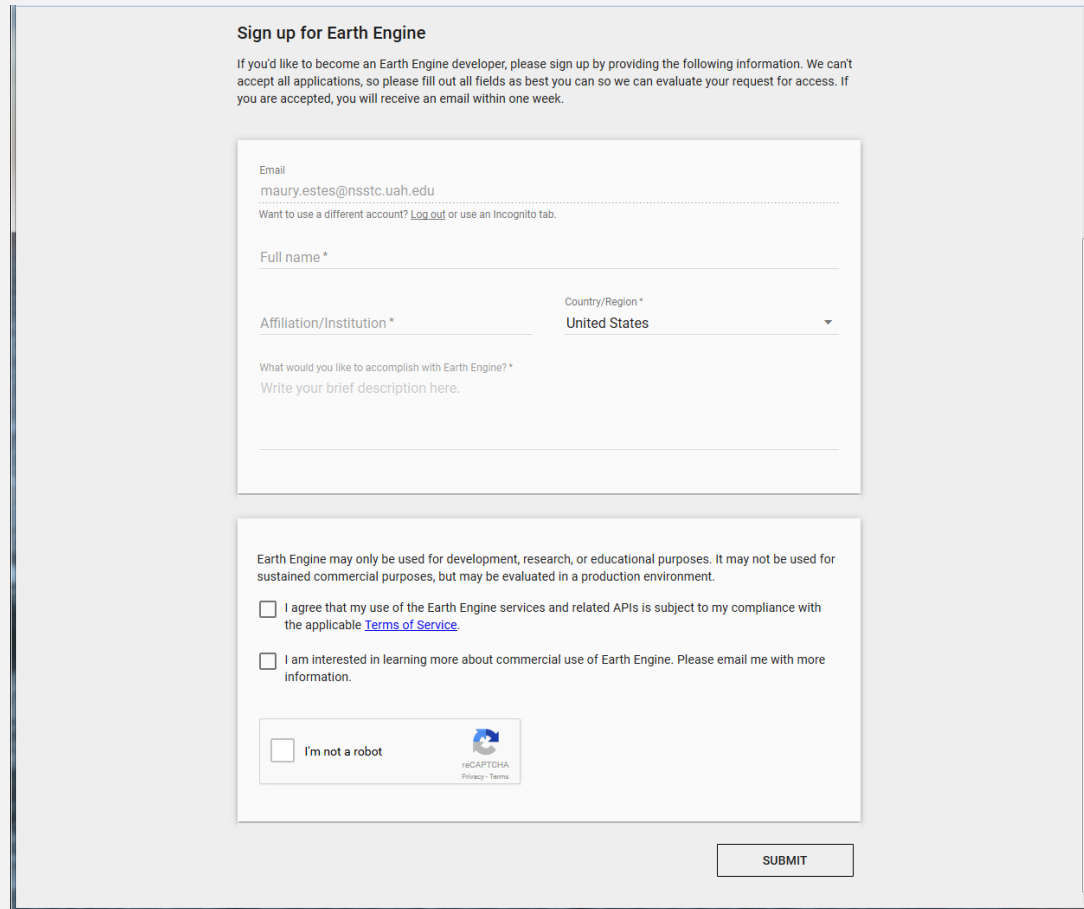


P. vivax transmission limit (2010)

Reported Malaria cases by country in the Indonesia region

Sign up for Earth Engine

<https://earthengine.google.com/signup>

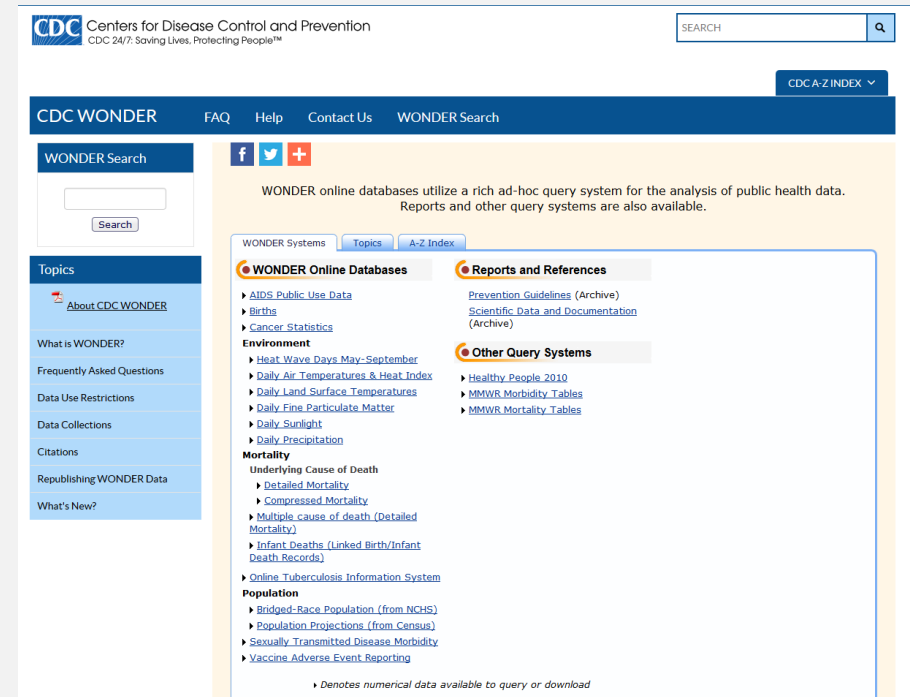


The screenshot shows the Earth Engine sign-up page. At the top, it says "Sign up for Earth Engine" followed by a paragraph explaining that users must provide information to be accepted, and if accepted, they will receive an email within one week. The form fields include: "Email" (filled with "maury.estes@nsstc.uah.edu"), "Full name *", "Affiliation/Institution *", "Country/Region *" (a dropdown menu showing "United States"), and "What would you like to accomplish with Earth Engine? *" (with a prompt to "Write your brief description here."). Below these fields are two checkboxes: "I agree that my use of the Earth Engine services and related APIs is subject to my compliance with the applicable Terms of Service" and "I am interested in learning more about commercial use of Earth Engine. Please email me with more information." At the bottom of the form is a reCAPTCHA widget with the text "I'm not a robot" and a "SUBMIT" button.

Earth Engine is free for research, education and non profit use

Acquiring Health Data

- **NASA doesn't collect health data**
- CDC, hospital admissions and emergency department records are good sources
- Mortality and morbidity plus location of death or illness are essential data to evaluate linkages between health outcomes and the physical environment
- **The Centers for Disease Control WONDER website** provides health data on a county wide scale for the U.S. <http://wonder.cdc.gov/>



Wrap-up

- Two NASA and two USGS based search and retrieval tools presented
 - All tools have features for spatial, temporal and thematic searches for data and information.
 - Which tool is best for you maybe a combination of personal preference and the type data you need.
- Google Earth Engine is a powerful resource for both data retrieval and geoprocessing analysis
 - Also a portal to various type of health related information

Homework: Reverb

1. Do a global data search, so no need for a bounding box
 - Set the temporal criteria for July 1-5, 2016
 - Set key science words as land surface temperature
 - Select this dataset from the list: MODIS/Aqua Land Surface Temperature/Emissivity 8-Day L3 Global 0.05Deg CMG V041
 - Search for granules
 - Compare side by side the two browse images one from June 25 to July 2 (1st image) and the other from July 3 (2nd image) to July 10 to answer these questions:
 - Q: Is the regional temperature for the Southeast United States warming, cooling or about the same between the 2 8-day composite images?
 - Q: Is the regional temperature for north Africa warming, cooling or about the same between the 2 8-day composite images?

Homework: Search, Acquiring, and Using Earthdata

Use the EARTH DATA tool to locate the dataset for Environmental Performance Index 2014 and access the health impacts file to answer the questions below

- Q: Is child mortality higher or lower in the year 1990 in the United States of America or Guadeloupe?
- Q: Same question in 2014?

Homework: GloVis

3. Use GloVis to find a L8 OLI/TIRS scene from 2016 that has less than 10% cloud cover for Metropolitan Atlanta (all areas inside I-285, the loop road)

- Write down the Landsat Scene Identifier
- Note the Cloud Cover Percent

Homework - GEE

- 4. Use Google Earth Engine to determine the following:
 - 4a. Since 1990 when did Malaria cases peak in Paraguay, South America?
 - 4b. What was the cause of this outbreak?